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EXAMINER	
BAIG, ADNAN	

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2461	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.**	**Applicant(s)**
	10/597,735	MALTSEV ET AL.
	Examiner	**Art Unit**
	ADNAN BAIG	2461

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 September 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-2, 4-9, 11-16, and 18-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,6-9,11-16 and 18-21* is/are rejected.

7)☒ Claim(s) *4 and 5* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments with respect to claims 1-3 and 6-21 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-2, 6, 8-9, 11, 15-16, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Serfaty (USP 5,293,401) in view of Kubo USP (5,081,651), and further in view of Okanoue USP (5,272,727).

Regarding Claim 1, Serfaty discloses a method to perform channel estimation, comprising:

receiving a first training sequence, **(see Col. 1 lines 55-58)**

estimating a maximum likelihood estimate **(See Fig. 6 Item 65)** of a channel impulse response using said first received training sequence, **(Referring to Fig. 6, Serfaty illustrates a maximum likelihood performed by Viterbi decoder 65 through forward and feedback filters 64 and 66, See Col. 8 line 47- Col. 9 lines 1-45**. **See G.**

D Forney, "Maximum-likelihood Sequence Estimation of Digital Sequences in the Presence of Intersymbol Interference", Pg 364 Fig. 2 & Pgs. 368-370).

receiving a second training sequence, and estimating at least one channel impulse response estimate (**See Fig. 6, Impulse Response evaluation & Col. 6 lines 35-40**) using said maximum likelihood estimate and said second received training sequence, (**See Col. 1 lines 50-62 & Col. 6 lines 33-46**).

Referring to (**Col. 6 lines 45-50**), Serfaty discloses the output of the DFE is compared to a set of predetermined thresholds to derive the estimated symbols.

Serfaty discloses estimating the channel impulse response during the second training sequence but does not expressly disclose estimating the channel impulse response using the maximum likelihood estimate, however the limitation would be rendered obvious in view of the teachings of Kubo USP (5,081,651).

Referring to Fig. 1, Kubo illustrates channel impulse response characteristic estimation circuit which estimates a channel impulse response characteristic on the basis of the estimated data sequence **(i.e., values)** outputted from the maximum likelihood estimation sequence circuit 1, **(see Col. 1 lines 20-43 & Col. 1 line 65 – Col. 2 lines 1-3**)

Kubo teaches the conventional maximum likelihood estimation encounters a problem of tracking the data of a time-varying channel impulse response characteristic which results in a delay, (**see Col. 2 lines 60-68**)

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention for using the maximum likelihood estimate in the disclosure of Serfaty for estimating the impulse response of the second training sequence by implementing the teachings of Kubo who discloses estimating a channel impulse response by using a data sequence outputted from a maximum likelihood data sequence to improve the delays experienced of time varying channel impulse response characteristic.

The combination of Serfaty in view of Kubo do not expressly disclose wherein estimating said channel impulse response estimate comprises: receiving said maximum likelihood estimate, generating a set of threshold values using said maximum likelihood estimate, generating a set of candidate channel impulse response estimate vectors using said threshold values, and selecting said channel impulse response estimate from said candidate channel impulse response estimate vectors, however the limitation would be rendered obvious in view of the teachings of Okanoue USP (5,272,727).

Okanoue discloses generating a set of threshold values using a maximum likelihood estimate (**Fig. 1, Maximum Likelihood Sequence Estimator**), generating a set of candidate channel impulse response estimate vectors using said threshold values (**see**

Col. 2 lines 29-45), and selecting said channel impulse response estimate from said candidate channel impulse response estimate vectors, (**see Col. 2 line 45 – Col. 3 lines1-12)**

Referring to Fig. 1, Okanoue illustrates maximum likelihood sequence estimator which generates an output decision sequence (***i.e., threshold values***) represented by the vector i(K). The output sequence is fed to impulse response channel estimators “20”, where the communication channel impulse response vectors are represented, (**see Col. 3 lines 25 – Col. 4 lines 1-21 & Col. 5 lines 10-16, 41-51)**)

Okanoue teaches maximum likelihood sequence estimation is a well known technique for recovering a transmitted information sequence corrupted by inter-symbol interference. A channel estimator is connected in parallel with a maximum likelihood sequence estimator (MLSE) to detect the impulse response of the channel with which the MLSE algorithm is adaptively controlled, where the invention aims to provide a MLSE capable of tracking the rapid varying impulse response of a communication channel, (**see Col. 1 lines 14-38**)

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention for estimating at least one channel impulse response estimate using a maximum likelihood estimate and a second received training sequence as taught by the combination of Serfaty in view of Kubo, by implementing the teachings of Okanoue who

discloses generating a set of threshold values using said maximum likelihood estimate, generating a set of candidate channel impulse response estimate vectors using said threshold values, and selecting said channel impulse response estimate from said candidate channel impulse response estimate vectors, because the teaching lies in Okanoue to solve the problems of conventional methods by using an adaptive maximum likelihood sequence estimator capable of adapting to the rapid varying impulse response of a communication channel.

Regarding Claim 2, the combination of Serfaty in view of Kubo, and further in view of Okanoue, disclose the method of claim 1, wherein estimating said maximum likelihood estimate comprises:

filtering said first received training sequence using a filter **(Serfaty, see Fig. 6 Items 64 and 66 & Col. 2 lines 3-14)** matched to said first received training sequence to form a first set of vectors for a matrix **(Serfaty, See Col. 4 lines 10-45)**.

transforming said matrix to form said maximum likelihood estimate, **(Referring to Fig.6, Serfaty illustrates the output of Item 66 which contains the matrix is sent to Item 65, where the maximum likelihood estimate is formed, see Col. 4 (Lines 35-45))**.

Regarding Claim 6, the combination of Serfaty in view of Kubo, and further in view of Okanoue disclose the method of claim 1, wherein said selecting comprises:

filtering said first received training sequence **(Serfaty, see Fig. 6 "Receive filter")** using said candidate channel impulse response estimate vectors to form a second set

of vectors, **(Serfaty, See Col. 4 Lines (45-60) where the Impulse response is selected or given. Referring to Fig. 3 Item 26, the decision feedback equalizer filters the impulse response estimate vectors which contain the first training sequence). A second set of channel impulse response vectors will be generated and the process will repeat since a second training sequence is received in the channel, see Col. 1 lines 59-62).**

determining a set of distance values between said second set of vectors and said second received training sequence, **(The coefficients or values, are determined where frames refer to the coefficients of each set of vectors and a second frame is introduced, Serfaty, see Col. 2 lines 18-25**).

selecting a minimum distance value from said set of distance values; and selecting said channel impulse response estimate vector using said minimum distance value, **(Serfaty, See Col. 2 lines 25-38, the midpoint or minimum distance is used in the frame for quality purposes and the channel impulse response is selected within the frame as shown in Col. 4 lines 40-45**).

Regarding Claim 8, Serfaty discloses a system, comprising:

a maximum likelihood estimator **(See Fig. 6 Item 65)** to generate a maximum likelihood estimate using a first received training sequence, **(Referring to Fig. 6, Serfaty illustrates a maximum likelihood performed by Viterbi decoder 65 through**

forward and feedback filters 64 and 66, See Col. 8 line 47- Col. 9 lines 1-45. **See G. D Forney, "Maximum-likelihood Sequence Estimation of Digital Sequences in the Presence of Intersymbol Interference", Pg 364 Fig. 2 & Pgs. 368-370**).

a channel tap estimator to couple to said maximum likelihood estimator, (**See Col. 4 lines 4-8**, **Referring to Figure 6, The channel Taps C(1) and C(K2) are shown in Item 66, decision feedback equalizer takes the output of Item 65 as its input. Item 66 receives a second training sequence as mentioned in Col. 1 (Lines 50-59)).**

said channel tap estimator to receive said maximum likelihood estimate and a second received training sequence, said channel tap estimator to generate at least one channel impulse response estimate using said maximum likelihood estimate and said second received training sequence, (**see Col. 1 (Lines 50-62), the channel impulse response estimate is generated by item 66 Fig. 6, Col. 4 Lines (13-16). Referring to Fig. 6, the Channel Tap estimator uses said maximum likelihood where Item 66 takes the output of Item 65**).

Referring to Fig. 3, Serfaty illustrates a channel impulse response selector (**impulse response evaluation 22 and DFE coefficients evaluation 23**) where the impulse response of the channel at the training instant (***i.e., first* or *second***) is estimated in evaluator 22. Interpolation is then used between the last estimated impulse response

and the present one to compute (***i.e., minimum distance value between training sequences***) it between training intervals, **(see Col. 6 lines 33-44**)

See **(Col. 2 lines 25-38),** the midpoint or minimum distance is used in the frame for quality purposes and the channel impulse response is selected within the frame as shown in **(Col. 4 lines 40-45)**

Referring to (**Col. 6 lines 45-50**), Serfaty discloses the output of the DFE is compared to a set of predetermined thresholds to derive the estimated symbols.

Serfaty discloses estimating the channel impulse response during the second training sequence, but does not expressly disclose estimating the channel impulse response using the maximum likelihood estimate, however the limitation would be rendered obvious in view of the teachings of Kubo USP (5,081,651).

Referring to Fig. 1, Kubo illustrates channel impulse response characteristic estimation circuit which estimates a channel impulse response characteristic on the basis of the estimated data sequence (**i.e., values**) outputted from the maximum likelihood estimation sequence circuit 1, **(see Col. 1 lines 20-43 & Col. 1 line 65 – Col. 2 lines 1-3**)

Kubo teaches the conventional maximum likelihood estimation encounters a problem of tracking the data of a time-varying channel impulse response characteristic which results in a delay, **(see Col. 2 lines 60-68)**

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention for using the maximum likelihood estimate in the disclosure of Serfaty for estimating the impulse response of the second training sequence by implementing the teachings of Kubo who discloses estimating a channel impulse response by using a data sequence outputted from a maximum likelihood data sequence to improve the delays experienced of time varying channel impulse response characteristic.

The combination of Serfaty in view of Kubo do not expressly disclose wherein said channel tap estimator comprises: a threshold generator to receive said maximum likelihood estimate and generate a set of threshold values using said maximum likelihood estimate; a candidate channel impulse response generator to receive said threshold values, and to generate a set of candidate channel impulse response estimate vectors using said threshold values; and a channel impulse response selector to receive said candidate channel impulse response estimate vectors and a minimum distance value, said channel impulse response selector to use said candidate channel impulse response estimate vectors and said minimum distance value to select said channel impulse response estimate, however the limitation would be rendered obvious in view of the teachings of Okanoue USP (5,272,727).

Okanoue discloses a threshold generator (**Fig. 1, Maximum Likelihood Sequence Estimator**), for generating a set of threshold values using a maximum likelihood estimate, a candidate channel impulse generator (**see Fig. 1, Channel Impulse Response estimators 20**) for generating a set of candidate channel impulse response estimate vectors using said threshold values (**see Col. 2 lines 29-45**), and selecting said channel impulse response estimate from said candidate channel impulse response estimate vectors, (**see Col. 2 line 45 – Col. 3 lines 1-12)**

Referring to Fig. 1, Okanoue illustrates maximum likelihood sequence estimator which generates an output decision sequence (***i.e., threshold values***) represented by the vector i(K). The output sequence is fed to impulse response channel estimators "20", where the communication channel impulse response vectors are represented, (**see Col. 3 lines 25 – Col. 4 lines 1-21 & Col. 5 lines 10-16, 41-51)**)

Okanoe teaches maximum likelihood sequence estimation is a well known technique for recovering a transmitted information sequence corrupted by inter-symbol interference. A channel estimator is connected in parallel with a maximum likelihood sequence estimator (MLSE) to detect the impulse response of the channel with which the MLSE algorithm is adaptively controlled, where the invention aims to provide a MLSE capable of tracking the rapid varying impulse response of a communication channel, (**see Col. 1 lines 14-38**)

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention for estimating at least one channel impulse response estimate using a maximum likelihood estimate and a second received training sequence, where selecting of the channel impulse response estimate is performed by a selector based on a minimum distance value as taught by the combination of Serfaty in view of Kubo, by implementing the teachings of Okanoue who discloses generating a set of threshold values using said maximum likelihood estimate, generating a set of candidate channel impulse response estimate vectors using said threshold values, and selecting said channel impulse response estimate from said candidate channel impulse response estimate vectors, because the teaching lies in Okanoue to solve the problems of conventional methods by using an adaptive maximum likelihood sequence estimator capable of adapting to the rapid varying impulse response of a communication channel.

Regarding Claim 9, the combination of Serfaty in view of Kubo, and further in view of Okanoue disclose the system of claim 8, wherein said maximum likelihood estimator comprises:
a filter to receive said first received training sequence, said filter to filter said first received training sequence to form a first set of vectors for a matrix, (**Serfaty, see Col. 2 lines 8-14**).

a matrix transformer to transform said matrix to form said maximum likelihood estimate,

(Referring to Fig.6, Serfaty illustrates the output of Item 66 which contains the matrix is sent to Item 65, where the maximum likelihood estimate is formed, see Col. 4 (Lines 35-45)).

Regarding Claim 11, the combination of Serfaty in view of Kubo, and further in view of Okanoue disclose the system of claim 8, further comprising:

a filter to receive said first received training sequence and said candidate channel impulse response estimate vectors, **(Referring to Fig. 6 Serfaty illustrates Item 66, the decision feedback equalizer contains a feedback FIR filter as mentioned which receives the first training sequence and channel impulse response vectors, see Col. 2 Lines 8-14**).

said filter to filter said first received training sequence using said candidate channel impulse response estimate vectors to form a second set of vectors; **(a second set of channel impulse response vectors will be generated and the process will repeat since a second training sequence is received in the channel, Serfaty, see Col. 1 lines 59-62**).

a distance calculator to receive a second training sequence and said second set of vectors, said distance calculator to determine a set of distance values between said second set of vectors and said second received training sequence; **(see Col. 2 lines 18-25 where the coefficients or values, are determined where frames refer to the**

coefficients of each set of vectors and a second frame is introduced, see Col. 5 Lines 65-68. "N" refers to the length or distance in frames).

a minimum selector to receive said distance values and select a minimum distance value from said set of distance values, and output said minimum distance value to said channel impulse response selector, **(Serfaty, the midpoint or minimum distance is used in the frame for quality purposes and the channel impulse response is selected within the frame as shown in Col.4 Lines (40-45) & Col.2 Lines (25-38)).**

Regarding Claim 15, the claim is directed towards a computer readable medium containing stored instructions when executed by a computer processor perform the method of claim 1. Therefore claim 15 is rejected under Serfaty in view of Kubo, and further in view of Okanoue, as in claim 1.

Regarding Claim 16, the combination of Serfaty in view of Kubo, further in view of Okanoue disclose the article of claim 15, wherein the stored instructions, when executed by a computer processor, further result in estimating said maximum likelihood estimate by filtering said first received training sequence using a filter (**Serfaty, See Fig. 6 Items 64 and 66 & Col. 2 lines 3-14**) matched to said first received training sequence to form a first set of vectors for a matrix **(Serfaty, See Col. 4 lines 10-45**), and transforming said matrix to form said maximum likelihood estimate, (**Referring to Fig. 6, Serfaty illustrates the output of Item 66 which contains the matrix is sent to**

Item 65, where the maximum likelihood estimate is formed, see Col. 4 (Lines 35-45)).

Regarding Claim 18, the combination of Serfaty in view of Kubo, further in view of Okanoue disclose the article of claim 15, wherein the stored instructions, when executed by a computer processor, further result in said selecting by filtering said first received training sequence **(Serfaty, see Fig. 6 "Receive filter")** using said candidate channel impulse response estimate vectors to form a second set of vectors, **(Serfaty, See Col. 4 Lines (45-60) where the Impulse response is selected or given. Referring to Fig. 3 Item 26, the decision feedback equalizer filters the impulse response estimate vectors which contain the first training sequence). A second set of channel impulse response vectors will be generated and the process will repeat since a second training sequence is received in the channel, see Col. 1 lines 59-62).**

determining a set of distance values between said second set of vectors and said second received training sequence, (**The coefficients or values, are determined where frames refer to the coefficients of each set of vectors and a second frame is introduced, Serfaty see Col. 2 lines 18-25**).

selecting a minimum distance value from said set of distance values, and selecting said channel impulse response estimate vector using said minimum distance value,

(**Serfaty, See Col. 2 lines 25-38, the midpoint or minimum distance is used in the frame for quality purposes and the channel impulse response is selected within the frame as shown in Col. 4 lines 40-45**).

4. Claims 7, 12-14, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Serfaty (USP 5,293,401) in view of Kubo USP (5,081,651), further in view of Okanoue USP (5,272,727), and further in view of Ketchum (US 2003/0185310).

Regarding Claim 7, the combination of Serfaty in view of Kubo, and further in view of Okanoue, discloses the method of claim 1 and teaches that a problem exists where impulse responses of periodic training sequences experience fading and multi-path spread changes (**Serfaty, see Col. 1 lines 44-50**), however

The combination of Serfaty in view of Kubo, and further in view of Okanoue do not disclose receiving said channel impulse response estimate at a crosstalk filtering module to form a channel impulse response matrix; creating a crosstalk suppression filter matrix based on said channel impulse response matrix; filtering a plurality of data streams over a channel for a multiple input multiple output system to reduce crosstalk between said data streams using said crosstalk suppression filter matrix. However the limitation is known in the art of communications as evidence by Ketchum (US 2003/0185310).

Ketchum discloses receiving said channel impulse response estimate at a crosstalk filtering module **(see Fig. 1 Item 170)** to form a channel impulse response matrix, (**see paragraph [0018]**).

creating a crosstalk suppression filter matrix (**see Fig. 1 Item 170**) based on said channel impulse response matrix, **([0007] see Lines 3-11 and Fig. 1 which illustrates the impulse response for the received symbol vector r(n) wherein a noise vector Z(n) is processed at the receiver, and is transmitted through a suppression filter).**

filtering a plurality of data streams over a channel for a multiple input multiple output system (**see Fig. 3**) to reduce crosstalk between said data streams using said crosstalk suppression filter matrix (**Fig. 1 item 170**), **(See paragraph ([0007] see Lines 13-18).**

Ketchum teaches a MIMO system can provide improved transmission performance, (**see paragraph [0004]**).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include the teachings of the combination of Serfaty in view of Kubo, and further in view of Okanoue, by receiveing the impulse response estimates at a crosstalk filtering module, creating a crosstalk suppression filter matrix, and filtering a plurality of data streams over a MIMO system as taught by Ketchum, to provide improved transmission performance in a MIMO system.

Regarding Claim 12, the combination of Serfaty in view of Kubo, and further in view of Okanoue discloses the system of claim 8 and teaches that a problem exists where impulse responses of periodic training sequences experience fading and multi-path spread changes (**see Col. 1 lines 44-50**), however

The combination of Serfaty in view of Kubo, and further in view of Okanoue do not disclose a communications medium; a plurality of transmitters to connect to said communications medium, with each transmitter to transmit a data stream over said communications medium using a communications channel; a plurality of receivers to connect to said communications medium, said plurality of receivers to receive said data streams from said communications channel; a crosstalk filtering module to connect to said plurality of receivers, said crosstalk filtering module to receive said channel impulse response estimate and use said channel impulse response estimate to filter said data streams to reduce crosstalk signals incurred by said data streams during said transmission. However the limitation is known in the art of communications by evidence of Ketchum (US 2003/0185310).

Ketchum discloses a communications medium (**see Fig. 1 MIMO channel 130**); a plurality of transmitters (**see Fig. 3 items 322a & 322t)** to connect to said communications medium, with each transmitter to transmit a data stream over said communications medium using a communications channel, (**see paragraph [0069]**).

a plurality of receivers **(see Fig. 3 items 352a & 352r)** to connect to said communications medium, said plurality of receivers to receive said data streams from said communications channel, **(see paragraph [0070])**.

a crosstalk filtering module (**Fig.1 Item 170**) to connect to said plurality of receivers, said crosstalk filtering module to receive said channel impulse response estimate and use said channel impulse response estimate to filter said data streams to reduce crosstalk signals incurred by said data streams during said transmission, **([0007] see Lines 3-11 and Fig. 1 which illustrates the impulse response for the received symbol vector r(n) wherein a noise vector Z(n) is processed at the receiver, and is transmitted through a suppression filter 170).**

Ketchum teaches a MIMO system can provide improved performance, **(see paragraph [0004])**.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include the teachings of the combination of Serfaty in view of Kubo, and further in view of Okanoue, within the system of Ketchum, because the teachings of Ketchum, show that a MIMO system can provide improved transmission performance.

Regarding Claim 13, the combination of Serfaty in view of Kubo, further in view of Okanoue, and further in view of Ketchum disclose the system of claim 12, further comprising a plurality of equalizers **(Ketchum, Fig.1 items 172 & 174**) to connect to said filtering module, said equalizers to equalize said filtered data streams **(Ketchum, [0007] see lines 7-15)** using a set of substantially similar equalization parameters. **(Referring to Fig. 1, Ketchum illustrates a plurality of data streams by vector r(n) [0031], where r(n) is filtered through filter 172. Ketchum teaches a corresponding equal matched filter for each individual set of plurality data streams which outputs equal impulse responses for each data stream that is filtered, [0040-0043]).**

(Referring to Fig. 1, Ketchum illustrates using distortion estimates as equalization parameters, see [0038] lines 1-11 & [0034]).

Regarding Claim 14, the combination of Serfaty in view of Kubo, further in view of Okanoue, and further in view of Ketchum disclose the system of claim 12, wherein said crosstalk filtering module comprises:

a channel impulse response matrix generator to generate a channel impulse response matrix, **see paragraphs [0018] & [0044-0048]**.

a crosstalk suppression filter matrix generator to generate a crosstalk suppression filter matrix (**see Fig. 1 item 170)** using said channel impulse response matrix; **([0007] see**

Lines 3-11 and Fig. 1 which illustrates the impulse response for the received symbol vector r(n) wherein a noise vector Z(n) is processed at the receiver, and is transmitted through a suppression filter).

a filter to filter said data streams using said crosstalk suppression filter matrix, (**see paragraph ([0007] see Lines 13-18**).

Regarding Claim 19, the combination of Serfaty in view of Kubo, further in view of Okanoue disclose the article of claim 15 as cited above.

Serfaty teaches that a problem exists where impulse responses of periodic training sequences experience fading and multi-path spread changes, and proposes a compensation for the problem (**see Col. 1 lines 44 - Col. 2 lines 1-2**).

The combination of Serfaty in view of Kubo, further in view of Okanoue do not disclose wherein the stored instructions, when executed by a computer processor, further result in receiving said channel impulse response estimate at a crosstalk filtering module to form a channel impulse response matrix, creating a crosstalk suppression filter matrix based on said channel impulse response matrix, and filtering a plurality of data streams received over a channel for a multiple input multiple output system to reduce crosstalk between said data streams using said crosstalk suppression filter matrix. However the

limitations would be rendered obvious in view of the teachings of Ketchum (US 2003/0185310)

Ketchum discloses receiving said channel impulse response estimate at a crosstalk filtering module (**see Fig. 1 Item 170**) to form a channel impulse response matrix, (**see paragraph [0018]**).

creating a crosstalk suppression filter matrix (**see Fig. 1 Item 170**) based on said channel impulse response matrix **([0007] see Lines 3-11 and Fig. 1 which illustrates the impulse response for the received symbol vector r(n) wherein a noise vector Z(n) is processed at the receiver, and is transmitted through a suppression filter).**

filtering a plurality of data streams received over a channel for a multiple input multiple output system (**see Fig. 3**) to reduce crosstalk between said data streams using said crosstalk suppression filter matrix, (**Fig. 1 item 170**), **(See paragraph ([0007] see Lines 13-18).**

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention for receiving said channel impulse response estimate at a crosstalk filtering module to form a channel impulse response matrix, creating a crosstalk suppression filter matrix based on said channel impulse response matrix, and filtering a plurality of data streams received over a channel for a multiple input multiple output system to

reduce crosstalk between said data streams using said crosstalk suppression filter matrix as taught by Ketchum, within the teachings of the combination of Serfaty in view of Kubo, further in view of Okanoue, for compensating for multipath.

5. Claims 20-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Serfaty (USP 5,293,401) in view of Kubo USP (5,081,651), further in view of Okanoue USP (5,272,727) and further in view of Gosh (US 2006/0114981).

Regarding Claim 20, the combination of Serfaty in view of Kubo, and further in view of Okanoue, discloses the method of Claim 1, further comprising:

estimating a second maximum likelihood estimate **(See Fig. 6 Item 65)** of a channel impulse response using said second received training sequence (**Referring to Fig. 1, Serfaty illustrates a maximum likelihood performed by Viterbi decoder 65 through forward and feedback filters 64 and 66, See Col. 8 line 47- Col. 9 lines 1-45**. **See G. D Forney, "Maximum-likelihood Sequence Estimation of Digital Sequences in the Presence of Intersymbol Interference", Pg 364 Fig. 2 & Pgs. 368-370**).

estimating a second channel impulse response estimate **(See Fig. 6, Impulse Response evaluation & Col. 6 lines 35-40)** using said second maximum likelihood estimate and said first received training sequence, (**See Col. 1 lines 50-62 & Col. 6 lines 33-46**).

Since training sequences are received periodically, it would be obvious for the "Viterbi Decoder" of Fig. 6 to perform a second maximum likelihood estimate for a second received training sequence to provide estimates of a second channel impulse response, **See Col. 1 lines 50-55 & lines 59-62**).

Serfaty teaches that a problem exists where impulse responses of periodic training sequences experience fading and multi-path spread changes **(see Col. 1 lines 44-50)**.

The combination of Serfaty in view of Kubo, further in view of Okanoue do not disclose averaging said channel impulse response estimates to find an averaged channel impulse response estimate. However the limitation is known in the art of communications by evidence by Ghosh (US 2006/0114981).

Ghosh discloses a method of averaging the channel estimates or channel impulse response estimates in a communication channel, **(see paragraphs [0065-0066])**.

Ghosh teaches an improved method for providing estimating multi-path channel for improved performance in the presence of interference, **see paragraph [0009]**.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention, to include the teachings of the combination of Serfaty in view of Kubo, and

further in view of Okanoue, within the system of Ghosh, because the teaching of Ghosh shows overall improvement of interference.

Regarding Claim 21, the combination of Serfaty in view of Kubo, and further in view of Okanoue, discloses the method according to claim 1, further comprising receiving an i-th training sequence, (**Serfaty teaches multiple sequences are transmitted in the channel, see Col. 1 lines 50-53**).

Estimating an M channel impulse response estimate using said i-th training sequence, (**Serfaty, see Col. 4 lines 10-45)**.

Serfaty teaches that a problem exists where impulse responses of periodic training sequences experience fading and multi-path spread changes (**see Col. 1 lines 44-50**).

The combination of Serfaty in view of Kubo, and further in view of Okanoue do not disclose averaging said M channel impulse response estimates to find an averaged channel impulse response estimate. However the limitation is known in the art of communications as evidence by Ghosh (US 2006/0114981).

Ghosh discloses a method of averaging the channel estimates or channel response estimates (i.e., "M") to find an averaged channel impulse response estimate, **see paragraph [0065-0066]**).

Ghosh teaches an improved method for providing estimating multi-path channel for improved performance in the presence of interference, **see paragraph [0009]**.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention, to include the teachings of the combination of Serfaty in view of Kubo, and further in view of Okanoue, within the system of Ghosh, because the teaching of Ghosh shows overall improvement of interference.

Allowable Subject Matter

6. Claims 4 and 5 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ADNAN BAIG whose telephone number is (571) 270-7511. The examiner can normally be reached on Mon-Fri 7:30m-5:00pm eastern Every other Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Huy Vu can be reached on 571-272-3155. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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